



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/009,837	01/20/1998	RANDELL L. MILLS	9113-23US	7937

7590 02/11/2004
FARKAS & MANELLI, PLLC
2000 M STREET, N.W.
7TH FLOOR
WASHINGTON,, DC 200363307

EXAMINER

TSANG FOSTER, SUSY N

ART UNIT	PAPER NUMBER
----------	--------------

1745

DATE MAILED: 02/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/009,837

Applicant(s)

MILLS, RANDELL L.

Examiner

Susy N Tsang-Foster

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2002 and 22 August 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 17-300 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 17-300 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 30,33 6) ☒ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: copies of 1) ATTACHMENT TO RESPONSE TO APPLICANT'S ARGUMENTS in paper #22; 2) Dr. Bernard Souw's Appendix, 3) Dr. Turner's original declaration; 4) NASA Technical Memorandum 107167 dated February 1996.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/22/2002 has been entered.

Response to Amendment

2. This Office Action is responsive to the amendment filed on 1/22/2002 (paper #28) and the amendment filed on 8/22/2002 (paper # 34). In the amendment filed on 8/22/2002, claim 131 was added. However, the last pending claim in the previous office action was claim 299. Under rule 1.126, when claims are added, they must be numbered by the applicant consecutively beginning with the number next following the highest numbered claim previously presented (whether entered or not). Therefore, newly added claim 131 is renumbered as claim 300. Claims 17-300 are pending and are rejected for reasons given below.

Information Disclosure Statement

3. The information disclosure statements filed on 8/22/2002 (paper # 33) and on 4/15/2003 (paper # 30) have been considered by the Examiner.

Art Unit: 1745

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 17-300 are rejected under 35 U.S.C. 101 because the disclosed invention is inoperative and therefore lacks utility.

See the reasons given in the previous Office Action mailed on 9/11/2000 (paper #14).

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 17-300 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

See the reasons given in the previous Office Action mailed on 9/11/2000 (paper #14).

Response to Arguments

8. Applicant's arguments filed 1/22/2002 and on 8/22/2002 have been fully considered but they are not persuasive.

Art Unit: 1745

From applicant's arguments of record it is evident that he rejects a century of work in quantum mechanics by those of skill in the art such as Nobel Laureates Schrodinger, Dirac, and Feynman as discussed in the ATTACHMENT TO RESPONSE TO APPLICANT'S ARGUMENTS in paper #22 mailed on 7/20/2001 (hereinafter referred to as "ATTACHMENT in paper #22") in favor of his own theory of the hydrogen atom that allegedly predicts a new form of the hydrogen atom known as the hydrino atom. However, applicant's theory of the hydrino atom fails to be a scientifically credible alternative in place of the conventionally established theory of quantum mechanics for the hydrogen atom for reasons given in the ATTACHMENT in paper #22 .

Applicant's claimed invention is based on the existence of the hydrino atom which is contrary to the known laws and theories of chemistry and physics. Applicant's theory of the hydrino atom predicts a new form of the hydrogen atom having energy states represented by fractional quantum numbers that are below the conventional ground state of the hydrogen atom. These energy states having fractional quantum numbers are contrary to the conventionally accepted energy states of the hydrogen atom having positive integer quantum numbers predicted by quantum mechanics that have been successfully verified by decades of independent, reproducible experimental results as stated in ATTACHMENT in paper #22.

As deduced from the experimentally observed spectrum of the H atom, it is well-established that it has a ground state energy level ($n = 1$) as well as excited energy states corresponding to integer values of $n > 1$. There is no experimental evidence besides applicant's

Art Unit: 1745

own interpretation of his data, that there are allegedly novel energy states corresponding to non-integer or fractional values of n for the hydrogen atom. Moreover, the spectrum of the H atom is accurately predicted by the well-known modern theory of quantum mechanics based on Schrodinger's equation and refinements thereof such as Dirac's equation as discussed in the ATTACHMENT in paper #22. There is no established modern theory of science that predicts energy levels of the hydrogen atom that would, if they were to exist, fall below the ground state energy of the hydrogen atom having fractional quantum numbers as predicted by applicant's theory. Indeed, scientists have continued to refine quantum mechanics to apply it to vastly more complex entities than the H atom and it is agreed amongst those of skill in the art that the properties of the hydrogen atom to date have been fully characterized to an extraordinarily high degree of accuracy as discussed in the ATTACHMENT in paper #22.

Another copy of the ATTACHMENT in paper #22 is attached to this Office Action for applicant's convenience. Applicant's arguments for the existence of the hydrino atom in the amendments filed on 1/22/2002 and on 8/22/2002 were previously made of record and were shown to be unpersuasive for reasons given in the ATTACHMENT in paper #22. It appears that applicant repeats his arguments which have already been fully addressed in the ATTACHMENT in paper #22.

Applicant also states that documents submitted of record show experimental support for applicant's fractional quantum number states of the hydrogen atom (a hydrogen atom existing in one of these fractional quantum number states is called a hydrino) that are hitherto unknown to

Art Unit: 1745

one of ordinary skill in the art. Applicant asserts in the amendment filed on 1/22/2002 on page 140 of the appendix that his spectral lines disprove quantum mechanics. It is noted that the experimental data submitted are largely applicant's own work which have not been conventionally accepted by those of ordinary skill in the art. However, the ATTACHMENT in paper #22 has already provided substantial evidence that the hydrino atom does not theoretically or physically exist as presently claimed and thus those skilled in the art would "reasonably doubt" the asserted utility and operability of applicant's invention (see ATTACHMENT in paper #22).

With respect to applicant's theory, sections 4 through 10 of the ATTACHMENT in paper #22 provide substantial evidence that applicant's theory is contradictory, physically unsound, and mathematically incorrect. Complementary scientific arguments demonstrating the incorrectness of applicant's theory can be found in the attached appendix by Dr. Bernard Souw, a patent examiner in art unit 2881, that was cited in copending case 09/513,768 which also claims the hydrino atom as the basis of the invention therein.

It is evident in the amendment filed on 1/22/2002 that applicant misrepresents the contents of the ATTACHMENT in paper #22 and the documents submitted of record by applicants that are referred to in the ATTACHMENT to paper #22. As an example, on pages 109-110 of the appendix in the amendment filed on 1/22/2002, applicant states that Dr. Turner in his declaration was referring to alkali hydrides, not $\beta\text{-Mg}_2\text{NiH}_4$ and that Dr. Turner communicated to the applicant at the time of initial NMR studies that metal hydrides such as transition metal and noble metal complex hydrides may have upfield shifted peaks, but no saline-

Art Unit: 1745

like or alkali or alkaline earth metal hydrides have been reported to have such shifts nor had he observed any such shifts in these class of compounds in his twenty or so years of NMR experience.

In contrast, the Dr. Turner's declaration submitted by applicant does not contain any of the above assertions made by applicant regarding what Dr. Turner communicated to him. A copy of the declaration is attached to this Office Action for applicant's convenience. Nowhere in Dr. Turner's declaration does he state that he had not observed any such shifts in these class of compounds in his twenty or so years of NMR experience. Instead, Dr. Turner states in his declaration at paragraph 8:

"Some of the samples showed signals in regions that are not typical. Most ^1H MAS NMR signals are observed from about 10 to 0 ppm, where ppm represents the shift from the control sample, tetramethylsilane. Signals were observed at -4 to -5 ppm. Since 1978, I have been primarily conducting NMR scans and I have never observed signals in the region of -4 to -5 ppm before."

As another example of applicant's misrepresentation of the contents of the ATTACHMENT in paper #22, applicant's states on page 119 of the appendix in the amendment filed on 1/22/2002 that NASA observed 11 W of excess power and that the Examiner offered no plausible explanation for the effect. The Examiner provided detailed reasons in section 21 of the ATTACHMENT in paper #22 for the 11 W excess power that was observed. A copy of the NASA document (NASA Technical Memorandum 107167 dated February 1996) is attached to

Art Unit: 1745

this Office Action for applicant's convenience. As stated in section 21 of the ATTACHMENT in paper #22, the NASA memorandum was unpersuasive because the authors of the Memorandum themselves stated on page 7 of the document that the outcome was such that they concluded that their data falls far short of being compelling. The authors went on to say on page 7 of the NASA Memorandum that the following factors are potential causes of multiwatt level, steady state, apparent excess heat for their experimental setup, namely:

- “1. Unrecognized nonlinearity in the cell thermal conductivity at low temperature differential, leading to erroneous extrapolation for the excess heat.
2. Injection of heat into the cell by thermoelectric pumping.
3. Exothermic chemical reactions involving the nickel cathode.
4. Heat from hydrogen-oxygen recombination within the cell.”

After further discussion in the memorandum, the authors of the NASA document conclude that “[f]ollowing the principle of simplest explanation that fits the data on hand, recombination becomes the explanation of choice.”

In response to applicant's repeated demands that the Examiner focus on his experimental results rather than his theory (see for example, page 44 of the amendment filed on 1/22/2002), it is critical to evaluate applicant's theory because he has introduced this theory into his claims as stated on page 5 of the ATTACHMENT in paper #22 where the relevant portion of which is reproduced below:

“While it is agreed that an inventor need not necessarily understand the theory behind his invention, attention is drawn to the fact that by reciting the phrases that include “hydrino atom” or equivalent terminology, such as, “hydrino hydride,” “increased binding energy hydrogen species,” etc. referring to something other than a “normal” hydrogen atom, in his claims, *the applicant has ipso facto introduced his theory of the “hydrino atom” into the claims.*

Moreover, a similar interpretation of an invention occurred in *Newman v. Quigg, op. cit.*, where an applicant's claims to a machine which operated according to a

Art Unit: 1745

theory which violated the second law of thermodynamics were held to be unpatentable. Hence it is clear why the examiner is obliged to review applicant's theory in addition to evaluating the experimental evidence alleged to support patentability of the present claims.

The applicant's theory is the *unique* source from which the existence of the "hydrino atom" is demonstrated. It is, therefore, natural and logical to interpret applicant's invention in terms of the basic underlying premise offered by applicant's theory."

Thus, in view of the above arguments, it is critical to evaluate applicant's theory to determine patentability of his claims. As stated above, applicant's theory is incredible for reasons given in the ATTACHMENT in paper #22 and in appendix by Dr. Bernard Souw.

In the amendments filed 1/22/2002 and 8/22/2002, applicant asserts that he has submitted a multitude of analytical studies experimentally confirming the disclosed novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n=1$) state. In response, applicant's experimental results have already been addressed in the ATTACHMENT to paper #22 and can be explained by conventional science (see NASA document example above) which does not involve the existence of the hydrino atom.

Applicant has recently submitted new plasma data that allegedly prove the existence of the hydrino atom in attachments 1-25 which correspond to the references cited in the information disclosure statement filed on 8/22/2002 (paper #33). It is noted that these 25 references submitted are applicant's own work which have not been reproduced and verified by independent laboratories. Nevertheless, the Examiner is unpersuaded by applicant's plasma data. For example, applicant's interpretation of the observation of line broadening in the plasma data due to a resonance transfer mechanism (r-t mechanism) is unconvincing because alternative

Art Unit: 1745

conventional explanations are equally plausible to explain the line broadening observed in the plasma data. It is well known that hydrogen transitions are easily perturbed by the plasma and microwave fields, since the atomic hydrogen has only one electron that is not protected by screening effects, especially those having large ℓ quantum numbers. Anomalous broadening of hydrogen lines in microwave plasma has been subjected to experimental and theoretical studies for decades (see Luggennh lscher et al. "Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen", obtained from <URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf>>).

In the reference by Mills et al. entitled "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts" that was submitted to IEEE Transactions on Plasma Science and cited in the information disclosure statement filed on 8/22/2002 (hereinafter referred to as 'Mills et al. "Comparison of Excessive Balmer α Line Broadening" document'), applicant asserts that the broadening of the hydrogen Balmer α line in microwave discharge plasma of a mixture containing predominantly argon and small amounts of hydrogen can be explained by a radiative transfer mechanism involving the species providing a net enthalpy of a multiple of 27.2 eV and atomic hydrogen (see p. 3 of Mills et al. "Comparison of Excessive Balmer α Line Broadening" document). However, conventional alternative theories can explain the broadening of the H α lines in the microwave discharge plasma of the Ar/H mixture as evidenced by Luque et al. "Experimental research into the influence of ion dynamics when measuring the electron density from the Stark broadening of the H α and H β lines", J. Phys. B: At. Mol. Opt. Phys. 36

Art Unit: 1745

(2003) pp. 1573-1584 and Luggenhölscher et al. "Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen", obtained from <URL:
<http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf>>.

Luque et al. carried out an analogous microwave discharge plasma experimental setup (see Figure 1 of Luque et al.) involving Ar gas where H was present in a trace amount. Luque et al. explained that under their operating conditions, the whole broadening attained by the profiles of the Balmer H α line is the result of two Lorentzian broadenings, the Stark (ω_S) and van der Waals (ω_W) ones and two Gaussian broadenings, the Doppler (ω_D) and the instrumental (ω_I) ones (see p. 1580 of Luque et al.). It appears in the Mills et al. "Comparison of Excessive Balmer α Line Broadening" document, applicant has not taken into account broadening of the line profile by the two Lorentzian broadenings in their microwave discharge plasma experiment involving the Ar/H mixture. Applicant state on page 13 of the Mills et al. "Comparison of Excessive Balmer α Line Broadening" document that only a Gaussian profile was used to fit the line profile of the Balmer α line. It appears that applicant ignored significant contributions to the line broadening due to dynamic Stark broadening (one of the components of Lorentzian broadening) in interpreting his own data.

Luque et al. was able to fully account for the line broadening of the Balmer H α line in a gas mixture comprising Ar and H only with two Lorentzian components and two Gaussian components as stated above. These components fully account for the broadening of the Balmer H α line due to proper analysis of the electron density and ion dynamics in the system by Luque

Art Unit: 1745

et al. There is no need to use a resonant energy transfer mechanism to explain the broadening of the Balmer H α line when an alternative conventional explanation offered by Luque fully accounts for the broadening of the H α line in a mixture of H₂/Ar in a microwave discharge experiment.

Furthermore, another microwave discharge experiment by Luggenhölscher et al. (“Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen”, obtained from <URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf>>) that similar to that disclosed in the Mills et al. “Comparison of Excessive Balmer α Line Broadening” document involving a hydrogen and an argon mixture shows anomalous line broadening of the Balmer H α line that can be attributed to microwave plasma effects. Applicant’s assertion that the extraordinary line broadening is due to a radiative transfer mechanism is not convincing because the line broadening can be due to conventional effects as explained above. Applicant has always assumed that the Doppler effect (the Gaussian component) was the main cause of the line broadening in microwave discharge plasmas as evidenced by the Mills et al. “Comparison of Excessive Balmer α Line Broadening” document. Applicant’s incorrect assertion regarding the mechanism of this line broadening in the Balmer H α line is enough to disqualify all of applicant’s arguments based on anomalous or excessive line broadening in microwave plasmas due to a resonance transfer (r-t) mechanism.

Art Unit: 1745

Thus, in view of the serious flaws in applicant's theoretical foundation for his invention and the lack of independent, reproducible experiments that verify the existence of the hydrino atom, applicant has failed to provide preponderance of evidence to support his claims.

Conclusion

Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

st/ 

Susy Tsang-Foster
Primary Examiner
Art Unit 1745

APPENDIX
by Bernard Eng-Kie Souw, Ph.D.
Patent Examiner, AU 2881

This Appendix particularly points out just a few of an overwhelmingly large number of errors in Applicant's Grand Unified Theory (GUT) of Classical Quantum Mechanics, provided by Applicant to the US Patent Office as a main support for Applicant's invention. In confirmation of the Examiner's § 101 rejection, this Appendix shows that the utility of Applicant's invention is *per se* incredible because its theoretical foundation as presented in GUT proves to be incorrect for the following reasons:

1. Applicant's fractional hydrogen levels are postulated, not derived from first principle.

Applicant obtained the fractional energy levels of his hypothetical *hydrino* (GUT pg.197, Eqs.5.1 & 5.2) **not by deriving** from first principle as claimed, but as a **postulate**. Nowhere in GUT is the fractional energy levels derived, but only *argued*, based on "non-radiative" nature of the hypothetical $1/n$ quantum states.

2. Applicant misunderstands that **all** stationary atomic states are *non radiative*.

If Applicant's definition of "*nonradiative states*" is to be followed, then **all** conventional stationary quantum states should be interpreted as "*nonradiative*". The wave function for an electron in hydrogen is derived from the Schrödinger equation by separating the time dependent part of the wave function, $\exp(-i2\pi Et/h)$. Thus, the spatial part $R(r) Y_{l,m}(\theta, \phi)$ is stationary, meaning literally, it

does not change with time. Moreover, the measurable quantity is not the wave function itself, but the electron probability density, which is defined as the absolute-square of the wave function, $|\Psi|^2 = \Psi^* \cdot \Psi \neq f(t)$, which is not a time-varying function, since the absolute-square of the time-varying component, $\exp(-i2\pi Et/h)$, is real and constant in time, i.e., static. Thus, per Applicant's own definition of "non-radiative" states (GUT pg. 113/line 3), a static charge density is trivially non-radiative. Consequently, all $n \geq 1$ quantum states are non-radiative, because the electron probability densities are static. This stationary property is also a consequence of the uncertainty principle. Since δE is zero, we have $\delta t = \infty$, which means, the wave function is stationary.

3. Applicant misunderstands why excited states do radiate, but the ground state does not.

The previous interpretation is nothing else but a *conventional* interpretation of QM. Indeed, stationary states are supposed to be stable in time. The reason why a $n > 1$ state does radiate through a transition from an upper state ($n_2 > 1$) to a lower state ($n_1 < n_2$) is because the transition probability between the two states is finite. This transition probability, P_{21} , is defined as being proportional to the overlap integral between the two wave functions involved, $P_{21} \sim \int \Psi_2^* \cdot (\mathbf{a} \cdot \mathbf{D}) \Psi_1 d^3\mathbf{r} \equiv \langle \Psi_2 | \mathbf{a} \cdot \mathbf{D} | \Psi_1 \rangle$ with \mathbf{a} = polarisation vector of the emitted photon and $\mathbf{D} = e \mathbf{r}$ is the electric dipole moment **operator** [1-3] where e is the electronic charge. Since the operator \mathbf{r} applied to an eigenfunction Ψ_1 of the Schrödinger equation in space representation is simply equal to eigenvalue ($=r$) times the eigenfunction,

i.e., $\int \Psi_2^* \Psi_1 d\tau$, the integral P_{21} receives the interpretation of an overlap integral between Ψ_2^* and Ψ_1 . This transition probability determines the spectral line intensity [1-4]. Obviously, a transition involving the ground state $n=1$ is only possible to the upper states $n>1$, which is not radiative but absorptive, meaning that the ground state $n=1$ is non radiative because the Schrödinger equation gives no physically meaningful solution for $n<1$. Thus, Applicant's statement in GUT/lines 4-6, that "*the Schrödinger equation gives no basis why excited states ($n>1$) are radiative and the 13,6 eV state (meaning the ground state, $n=1$) is stable*", is principally wrong.

4. Applicant misunderstands the most basic fundamentals of the QM theory.

Applicant is confusing the electron charge density, which is proportional to the probability density of an electron, with the electromagnetic wave generated by a moving charge, which satisfies the Maxwell and Helmholtz equations, the latter usually expressed in terms of the Laplace operator (GUT/Eq.1.1). According to elementary QM, the probability density $\rho(r,t)$ is defined as $\rho(r,t) \equiv \Psi^* \Psi$, but not as the wave function $\Psi(r,t)$ itself. While $\Psi(r,t)$ satisfies the Schrödinger equation, which contains a first order time-derivative, $\partial/\partial t$, it does not satisfy the wave or Laplace equation, which contains a second order time-derivative, $\partial^2/\partial t^2$. Thus, Applicant's expression for the probability density of a hydrogen electron (GUT Eq.1.9), cannot simultaneously satisfy the Schrödinger and electromagnetic wave/Laplace equations. A direct proof of Applicant's mistake can be very easily demonstrated by inserting Applicant's postulated electron wave function $\rho(r,t)$, as

given (only argued, not derived) in GUT, Eq. 7 on pg. 111 and Eq.10 on pg.112, into the Laplace equation, GUT Eq. 1.1 on pg.48, here using the conventional integral representation of the Dirac delta function (see [5] pg.480, Eq.A4-6) to calculate the first and second order derivatives, as generally mastered by one of ordinary skill in the art. Rigorously performing all mathematical operations, it comes out that Applicant's wave function $\rho(\mathbf{r},t)$ is **NOT at all** a solution of Eq. 1.1 as claimed by Applicant throughout his *hydrino* hypothesis. That Applicant's $\rho(\mathbf{r},t)$ is *neither* a solution of the Schrödinger equation is too obvious, since it does not contain the electron mass. This single mistake alone is already enough to disqualify Applicant's *hydrino* theory. Yet, a lot more mistakes are to be revealed next.

5. Applicant is mistaken in understanding and applying Haus's non-radiative condition.

Haus's condition for (non)radiative moving charge is derived through the **current** density \mathbf{J} , but not the charge density ρ . It is \mathbf{J} , which satisfies the wave equation with the Laplace operator, as recited in Haus's Eq.(3) [6]. In contradiction, Applicant's interpretation of Haus's condition states that the electron charge density $\rho(\mathbf{r},t)$ satisfies the (electromagnetic) wave equation, as unambiguously recited in the preceding sentence to GUT/Eq.1.9, "*The **solutions** of the classical wave equation are separable*", then followed by an expression for $\rho(\mathbf{r},t)$. Obviously, Applicant's formulation of Haus's condition in terms of electron material wave is based on wrong understanding of both Haus's electromagnetic theory and Schrödinger's QM theory.

6. Applicant is confusing QM eigenfunction with QM wave function.

QM eigenfunctions Ψ satisfy the equation $\mathbf{A}\Psi = A\Psi$, where \mathbf{A} is an **operator** (e.g., \mathbf{H} , $\partial/\partial t$ or $\partial/\partial x$) and A is an eigenvalue, which is no other than a plain number or quantity. A wave function is not an eigenfunction (of an operator), but it generally can be expressed as a *superposition* of eigenfunctions from a complete orthonormal set of such functions (QM principle of decomposition). In GUT, pg.64, Applicant's formulation of a wave function of an electron with spin in spherical symmetric systems as being a superposition of two spherical harmonic functions $Y_{l,m} + Y_{0,0}$ is basically wrong in *at least two aspects*.

Firstly, according to elementary quantum mechanics, such a wave function can not be an **eigenfunction** of the angular momentum operator, because the wave functions $y_{l,m} = Y_{l,m} + Y_{0,0}$ do not form a complete orthonormal set, the latter having to satisfy the condition $\langle y_{l,m} | y_{l',m'} \rangle = \delta_{l,l'} \delta_{m,m'}$. Applicant's $y_{l,m}$ is definitely *not* an *eigenfunction* of angular momentum operator, because the product $\langle y_{l,m} | y_{l',m'} \rangle$ results in $\int \{ (Y_{l,m})^* Y_{l,m} + (Y_{0,0})^* Y_{0,0} \} d\Omega = \delta_{l,l'} \delta_{m,m'} + 1 \neq \delta_{l,l'} \delta_{m,m'}$. In plain language, Applicant's $y_{l,m}$ is not orthogonal to $y_{l,m}$. Thus, it is incorrect to formally write $\mathbf{L}^2 y_{l,m} = l(l+1)(h/2\pi)^2 y_{l,m}$, or $\mathbf{L}_z y_{l,m} = -i(h/2\pi) y_{l,m}$, since it is generally known in the art, a superposition of eigenfunctions, $y_{l,m} = Y_{l,m} + Y_{0,0}$ does not yield an eigenvalue A in an eigenvalue equation $\mathbf{A}\Psi = A\Psi$, as demonstrated above, but an **expectation** value, defined as $\langle \mathbf{A} \rangle = \int \psi^* \mathbf{A} \psi d^3r$ where \mathbf{A} is the angular momentum operator, which – in coordinate representation — is given by ([5] pg. 205 Eq. 7-87) $\mathbf{A} \equiv \mathbf{L}^2 = -(h/2\pi)^2 \nabla^2_{\theta,\varphi}$ having an eigenvalue

$l(l+1)(\hbar/2\pi)^2$, or the angular momentum projection operator $L_z = -i(\hbar/2\pi)\partial/\partial\phi$ having an eigenvalue m ([7] pg. 93 Eq.25.23). Thus, Applicant's representation of wave functions in GUT/pg.64 Fig.1-2, is incorrect, because Applicant's wave function $y_{l,m} = Y_{0,0} + Y_{l,m}$ does not yield the *eigenvalue* $l(l+1)(\hbar/2\pi)^2$, but instead, an *expectation value* $\langle L^2 \rangle = \int \{ (y_{l,m})^* L^2 y_{l,m} d\Omega = l(l+1)(\hbar/2\pi)^2$. This is because $L^2 y_{l,m} = L^2 (Y_{l,m} + Y_{0,0}) = l(l+1)(\hbar/2\pi)^2 Y_{l,m} + 0 \neq l(l+1)(\hbar/2\pi)^2 (Y_{l,m} + Y_{0,0})$, and similarly, $L_z (Y_{l,m} + Y_{0,0}) = -i(\hbar/2\pi)m Y_{l,m} + 0 \neq -i(\hbar/2\pi)m (Y_{l,m} + Y_{0,0})$. Applicant's confusion between *eigenfunction* and *wave function* can be made further obvious by the following alternative argument: It is well known to one of ordinary skill in the art, if a wave function consists of a single eigenfunction (of an operator), its expectation value would have the same value as the eigenvalue. If $y_{l,m} = Y_{l,m} + Y_{0,0}$ is a solution of Applicant's "classical QM wave equation", then $y_{l,m} = a \cdot Y_{l,m} + b \cdot Y_{0,0}$ is also a valid solution, although it is not an eigenfunction but a linear superposition of eigenfunctions. Thus, the wave function $y_{l,m}$ cannot possibly be an eigenfunction (of the angular momentum operator), but instead, must be a superposition of eigenfunctions. Consequently, the correct (ortho)normalized representation of the wave function $y_{l,m}$ would bear a factor $1/\sqrt{2}$ in front of each eigenfunctions, or, in a general case, $a \cdot Y_{l,m} + b \cdot Y_{0,0}$ with $|a|^2 + |b|^2 = 1$, as usual, with $|a|^2$ being the probability to find the system in the (l,m) state, and $|b|^2$ the probability to be in a $(0,0)$ state. This new wave function $y_{l,m}$ yields an *expectation value* of $|a|^2 \cdot l(l+1)(\hbar/2\pi)^2$, which is not a *single* eigenvalue, but an average value depending on the (thus far arbitrary) components of the vector $y_{l,m} = a \cdot Y_{l,m} + b \cdot Y_{0,0}$. This completes the proof that Applicant's $y_{l,m}$ is not an

eigenfunction of the angular momentum operator, but a wave function, defined as a superposition of such eigenfunctions. The above distinction between eigenfunction and wave function is purely mathematical. It thus applies to both wave equation and Schrödinger equation.

Secondly, Applicant's representation of an eigen (wave?) function in terms of two eigenfunctions, $Y_{0,0}$ and $Y_{l,m}$, but only one of them having the time dependency, as recited in GUT, pg.61, Eq. 1.65a & 1.65b, is conceptually as well as mathematically incorrect, since both terms must be solutions of the same Laplace or Schrödinger equation, both of which are time dependent.

(7) Applicant misunderstands the Uncertainty Principle in QM

As a matter of fact, a superposition of two or more angular momentum eigenfunctions $Y_{l,m}$ is just a manifest of the QM uncertainty principle. The angular momentum eigenfunction $Y_{l,m}$ itself is stationary with respect to the angular coordinate θ , because each eigenfunction is sharply defined in angular momentum l , i.e., $\delta l = 0$. As an equivalent of the uncertainty relation $\delta x \cdot \delta p \approx h/2\pi$, we here have $\delta l \cdot \delta \theta \approx h/2\pi$. Thus, a sharply defined angular momentum, i.e., $\delta l = 0$, corresponds to a completely undefined angular position θ , i.e., $\delta \theta \rightarrow \infty$. However, by constructing an angular momentum "wave packet" made of a superposition of several, or many, eigenfunctions $Y_{l,m}$, we have a finite $\delta l > 0$, and hence, a finite $\delta \theta < \infty$. As a result, we now can "see" the electron wave packet at a definite angular position ϕ occupying an angular interval $\delta \theta$, exactly as displayed in Applicant's Fig.1.2 in GUT/pg.63. *This angular wave packet visualization used to be given as a routine exercise for undergraduate students*

*in physics to acquire a **correct** understanding of the uncertainty principle, when the author of this Appendix was teaching "Relativistic Quantum Mechanics" at the Technical University of Clausthal in Clausthal-Zellerfeld, Germany, in the 1970s.*

Therefore, Applicant's explanation given in GUT regarding Fig.1.2 is incorrect, and so is also Applicant's understanding of the uncertainty principle. The same judgement has been made by a number of other authors contributing to Ref. [8].

(8) Applicant's concept of electron spin is incorrect.

Applicant's representation of the electron spin function being identical to the angular momentum eigenfunction $Y_{0,0}$, as recited in GUT/pgs.61-66, Eq.1.61-65, is incorrect. In addition to its non-orthogonality, as proven previously, Applicant's erroneous representation of the spin eigenfunction will fail to work properly in a matrix diagonalization procedure to calculate the magnetic and electric field effects on energy level splittings and atomic transitions, because two basis vectors are missing, either of the angular momentum with $l=0$, or of the spin operator. On the other hand, application of conventional QM to hydrogen and helium atoms has been proven accurate in predicting the effects [1,2], which has been also experimentally verified to great accuracy by Doppler-free laser spectroscopy [3], all personally conducted by the author of the present Appendix.

Electron **spin** is an intrinsic property of the electron, completely independent of its angular momentum. In contradiction to Applicant's concept, the spin is not an external property like that of an electron orbiting an external atomic nucleus, but an intrinsic property, such as an eigen-rotation on its own

axis. Therefore, correct representation must be provided by an angular-momentum-independent and complete set of orthogonal basis vectors, which is conventionally represented by the Pauli spin functions, \mathbf{S} , more specifically as column vectors (1,0) and (0,1). This results in two simultaneous conventional Schrödinger eigenfunctions of energy and angular momentum, Ψ_+ representing spin-up and Ψ_- representing spin-down, both forming a new set of eigenfunctions (eigen vectors, or spinors), as explicitly recited by the author of this Appendix in Ref. [2], Eqs. 4 and 5. In this case, the spin operator is not represented by the angular momentum operator, as postulated by Applicant, but by the Pauli spin matrices, σ_x , σ_y , and σ_z , or alternatively, σ_+ , σ_- , and σ_z [1-3,5,7]. This two-component spinor representation can be further expanded to a four-component spinor formulation in order to render it Lorentz-covariant, from which a correct gyromagnetic ratio of the electron spin ($g_s=2$) automatically follows ([9], pg.25/lines 12-24), thus refuting Applicant's repeated allegation that conventional QM is not relativistically (Lorentz-)covariant.

(9) Applicant's hydrogen electron wave function is seriously flawed.

Applicant's formulation of hydrogen electron wave function leads to *self-contradiction* and is thus *incapable* of correctly predicting the multiplet intensities, the transition probabilities and their selection rules. The wave function in Applicant's classical antenna formula in GUT pg.144, Eq. 2.42 is incomplete for not including the radial function, rendering it incapable of deriving correct multiplet intensities or transition probabilities, because multiplet intensities and transition probabilities originate from the radial wave function. However, if

Applicant's $\delta(r-r_n)$ -like radial wave function is incorporated, Eq. 2.42 results in a selection rule proportional to $\delta(n-n')$, which is again incorrect, since $n_1 \rightarrow n_2$ transitions with $\Delta n \neq 0$ would then be prohibited. On the other hand, conventional QM is known to give accurate multiplet intensities, transition probabilities and their selection rules *simultaneously*, even under complicated Zeeman and Stark level splittings, as demonstrated in [1-3]. Applicant's failure to derive the correct multiplet intensities, transition probabilities and their selection rules, is a solid proof that Applicant's *hydrino* hypothesis is fundamentally wrong.

(10) Applicant's application of Special Relativity theory is incorrect.

Regarding Applicant's *relativistic length contraction*, described in footnote 2 in GUT/pg.55, it is to be *strongly emphasized* that an orbiting electron is **not an inertial system**, because we here have an acceleration in the radial direction. Thus, applying the *special relativistic* formula of length contraction, as recited in Eq.1 footnote 2, pg.55, is *fundamentally not allowed*. Furthermore, according to classical electromagnetic theory, accelerated charge will always radiate. Consequently, the whole result of Applicant's lengthy derivation & discussion on the relativistically length-contracted "*distance on a great circle*" (in plain language, the circumferential length of an electron orbit) is incorrect, for being based on a wrong understanding of the Special Theory of Relativity. Therefore, Applicant's hypothesis, or postulate, of fractional energy levels in hydrogen, as presented in GUT pg.197, Eqs.5.1 & 5.2, is incorrect.

Applicant's erroneous understanding of the Special Relativity theory is further manifested in Footnote 2, GUT pg.56, lines 1-8 from bottom, stating that Applicant's "*relativistic length contraction*" results in $t=2r/c$, which is interpreted by Applicant as a confirmation of the electron charge density going *straight through the atomic nucleus*, in accordance with the radial electron wave function for the ground state hydrogen ($n=1, l=0$), i.e., $R(r) \sim e^{-r}$, which allegedly remains finite at $r=0$. This, however, is *doubly incorrect*, since the *radial distribution* of the electron density is not given by $\sim R(r)$, but by $u^2 dr \sim R^2 r^2 dr$, which becomes zero at $r=0$, as given in [5], pg.222, Eq.7-178. Thus, the ground state hydrogen electron remains strictly in an orbit away from the nucleus, in direct contradiction to Applicant's *hydrino* hypothesis.

REFERENCES:


- [1] E.-K. Souw, Ph.D. Thesis 1981, University of Düsseldorf, Germany, titled "Investigations of Transport Phenomena in the Wall Region of a Helium Plasma by Means of Spectroscopic Methods", available on request.
- [2] E.-K. Souw et al., "Calculation of the Combined Zeeman and Translational Stark Effect on the H α Multiplet", Physica 122C (1983) pp. 353-374.
- [3] E.-K. Souw et al., "The Zeeman Splitting of the 5876 Å He Line Studied by Means of a Tunable Dye Laser", Physica 113C (1982) pp. 203-216.
- [4] NIST, "Atomic Spectroscopy - Spectral Line Shapes, etc.", available at: <http://physics.nist.gov/Pubs/AtSpec/node20html/>

- [5] J. L. Powell and B. Crasemann, "Quantum Mechanics", Addison Wesley Publ. Co., Inc., Reading MA – London UK, 1961.
- [6] H.A. Haus, "On the Radiation from point Charges", Am. J. Phys. 54 (12), 1986, 1126-1129.
- [7] D. I. Blochinzew, "Grundlagen der Quantenmechanik", VEB Deutscher Verlag der Wissenschaften, Berlin 1967.
- [8] "BlackLight Power – do they have something significant?" available at <http://www.phact.org/e/blr.htm>
- [9] J. D. Bjorken and S. D. Drell, "Relativistische Quantenmechanik", Bibliographisches Institut Mannheim, 1964.

DECLARATION OF DR. GARY L. TURNER

I, Gary L. Turner, declare and state that:

1. I received a Bachelor of Science degree in Chemistry from the University of Illinois, Urbana, Illinois in 1978 and a Doctorate degree in Physical Chemistry at the University of Arkansas, Fayetteville, Arkansas in 1982.
2. From July 1982 to June 1988, I was a research associate for Dr. E. Oldfield, at the University of Illinois, Urbana, Illinois.
3. From August 1985 to the present, I have been employed by Spectral Data Services, Inc., where my duties include conducting Nuclear-Magnetic-Resonance scans on sample materials.
4. From April 1986 to August 1990 I was also employed as the Vice-President of Probe Systems, Inc., where I was responsible for designing Nuclear-Magnetic-Resonance (NMR) equipment.
5. I have published 38 peer-reviewed scientific papers, a list of which is shown in the Attachment.
6. Over the last year, I conducted ^1H MAS NMR scans on about 100 blind samples of compounds provided by BlackLight Power, Inc.
7. A 270 MHz NMR Spectrometer, operating at a Larmor frequency of 270.6196 MHz was used. The Spectrometer was equipped with a Tecmag operating system and Henry Radio amplifiers for pulse generation. The probe was a 7 mm Doty Scientific Standard Probe. The data was collected with a pulse angle of about 35° , with a two second delay between pulses. The samples were spun at two speeds, usually at 4.5 and 3.5 KHz, to identify the spinning sidebands. Typically, 200 transients were collected for each spectrum. The data was processed using NUT (Acorn NMR, Inc.) software.
8. Some of the samples showed signals in regions that are not typical. Most ^1H MAS NMR signals are observed from about 10 to 0 ppm, where ppm represents the shift from the control sample, tetramethylsilane. Signals were observed at -4 to -5 ppm. Since 1978, I have been primarily conducting NMR scans and I have never observed signals in the region of -4 to -5 ppm before.
9. I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

By 
Dr. Gary L. Turner

Date: 5/18/00

ATTACHMENT

Published Papers of Dr. Gary L. Turner

1. G. L. Turner and E. Oldfield, "Effect of a local anaesthetic on hydrocarbon chain order in membranes," Nature **277**, 669-70 (1979).
2. J. F. Hinton, G. L. Turner, and F. S. Millett, "A thallium-205 NMR investigation of the thallium(I)-gramicidin complex," J. Magn. Reson. **45**, 42-47 (1981).
3. G. L. Turner, J. F. Hinton, and F. S. Millett, "A thallium-205 NMR study of thallium acetate ion association in 2,2,2-trifluoroethanol and dimethylsulfoxide," J. Sol. Chem. **11**, 379-86 (1982).
4. G. L. Turner, J. F. Hinton, and F. S. Millett, "Thallium-205 nuclear magnetic resonance study of the thallium(I)-gramicidin A association in trifluoroethanol," Biochem. **21**, 646-51 (1982).
5. J. F. Hinton, G. L. Turner, G. Young, and K. R. Metz, "Thallium-205 NMR studies of the Tl(I) ion complexation by gramicidin in non-aqueous and micelle solutions," Pure & Appl. Chem. **54**, 2359-68 (1982).
6. G. L. Turner, J. F. Hinton, and F. S. Millett, "A ²⁰⁵Tl and ¹³C NMR study of the Tl(I)-gramicidin A association in dimethylsulfoxide," J. Magn. Reson. **51**, 205-12 (1983).
7. G. L. Turner, J. F. Hinton, R. E. Koeppe II, J. A. Parli, and F. S. Millett, "Difference in association of Tl(I) with gramicidin A and gramicidin B in trifluoroethanol determined by Tl-205 NMR," Biochim. Biophys. Acta. **756**, 133-37 (1983).
8. J. F. Hinton and G. L. Turner, "Tl-205 and C-13 NMR study of the Tl(I)-enniatin B complex," J. Magn. Reson. **59**, 262-67 (1984).
9. R. J. Kirkpatrick, K. A. Smith, S. Schramm, G. Turner, and W. H. Yang, "Solid-state nuclear magnetic resonance spectroscopy of minerals," Ann. Rev. Earth Plant Sci. **13**, 29-47 (1985).
10. J. F. Hinton, K. R. Metz, G. L. Turner, D. L. Bennett, and F. S. Millett, "Solid-state thallium-205 NMR study of the gramicidin and lasalocid Tl(I) complexes," J. Magn. Reson. **64**, 120-123 (1985).

11. G. L. Turner, S. E. Chung, and E. Oldfield, "Solid-state oxygen-17 nuclear magnetic resonance spectroscopic study of the group II oxides," J. Magn. Reson. 64, 316-324 (1985).
12. R. J. Kirkpatrick, T. Dunn, S. Schramm, K. A. Smith, R. Oestrike, and G. Turner, "Magic-angle sample-spinning nuclear magnetic resonance spectroscopy of silicate glasses: a review," in Structure and Bonding in Non-Crystalline Solids, eds., G. E. Walrafen and A. G. Revesz, 303-327 (1986).
13. G. L. Turner, K. A. Smith, R. J. Kirkpatrick, and E. Oldfield, "Boron-11 nuclear magnetic resonance spectroscopic study of borate and borosilicate minerals, and a borosilicate glass," J. Magn. Reson. 67, 544-550 (1986).
14. A. C. Kunwar, G. L. Turner, and E. Oldfield, "Solid-state spin-echo Fourier transform NMR of ^{39}K and ^{67}Zn salts at high-field," J. Magn. Reson. 69, 124-127 (1986).
15. H. K. C. Timken, G. L. Turner, J. P. Gilson, L. B. Welsh, and E. Oldfield, "Solid-state oxygen-17 nuclear magnetic resonance spectroscopic study of zeolites and related systems. I.," J. Amer. Chem. Soc. 108, 7321-7235 (1986).
16. H. K. C. Timken, N. Janes, G. L. Turner, S. L. Lambert, L. B. Welsh, and E. Oldfield, "Solid-state oxygen-17 nuclear magnetic resonance spectroscopic study of zeolites and related systems. II.," J. Amer. Chem. Soc. 108, 7236-7241 (1986).
17. W. H. Yang, R. J. Kirkpatrick, and G. Turner, " ^{31}P and ^{29}Si MASS NMR investigation of the structural environment of phosphorus alkaline-earth silicate glass," J. Amer. Ceram. Soc. 69, C222-C223 (1986).
18. C. T. G. Knight, G. L. Turner, and E. Oldfield, "Solid-state tungsten-183 nuclear magnetic resonance spectroscopy," J. Amer. Chem. Soc. 108, 7426-7427 (1986).
19. G. L. Turner, K. A. Smith, R. J. Kirkpatrick, and E. Oldfield, "Structure and cation effects on phosphorus-31 NMR chemical shifts and chemical-shift anisotropies of orthophosphates," J. Magn. Reson. 70, 408-415 (1986).
20. G. L. Turner, R. J. Kirkpatrick, S. Risbud, and E. Oldfield, "Multi-nuclear magic-angle sample spinning nuclear magnetic resonance spectroscopic studies of crystalline and amorphous ceramic materials," J. Amer. Ceram. Soc. 66, 656-663 (1987).

21. R. Oestrike, A. Navrotsky, G. L. Turner, B. Montez, and R. J. Kirkpatrick, "The structural state of aluminum at low concentrations in $2\text{PbO} \cdot \text{B}_2\text{O}_3$ glasses used for solution calorimetry: An aluminum-27 NMR study," Amer. Mineral. **72**, 788-791 (1987).
22. B. C. Bunker, D. R. Tallant, C. A. Balfe, R. J. Kirkpatrick, G. L. Turner, and M. R. Reidmeyer, "Structure of phosphorus oxynitride glasses," J. Amer. Ceram. Soc. **70**, 675-81 (1987).
23. T. H. Walter, G. L. Turner, and E. Oldfield, "Oxygen-17 cross-polarization nuclear magnetic resonance spectroscopy of inorganic solids," J. Magn. Reson. **76**, 106-120 (1988).
24. J. Lipowitz and G. L. Turner, " ^{29}Si and ^{13}C magic angle sample spinning nuclear magnetic resonance spectroscopy of amorphous ceramic fibers prepared by prolysis of organosilicon polymers," Polymer Preprints **29**, 74-77 (1988).
25. R. C. Bunker, D. R. Tallant, T. J. Hendley, G. L. Turner, and R. J. Kirkpatrick, "The structure of leached sodium borosilicate glass," Phys. Chem. Glass, **29**, 106-120 (1988).
26. B. C. Bunker, C. H. F. Peden, D. R. Tallant, S. L. Martinez, and G. L. Turner, "Raman and NMR studies of hydrous sodium titanates," Mat. Res. Soc. Symp. Proc. **121**, 105-109 (1988).
27. K. L. Geisinger, R. Oestrike, A. Navrotsky, G. L. Turner, and R. J. Kirkpatrick, "Thermochemistry and structure of glasses along the join $\text{NaAlSi}_3\text{O}_8$, NaBSi_3O_8 ," Geochim. Cosmoch. Acta. **52**, 2405-2414 (1988).
28. B. C. Bunker, D. R. Tallant, R. J. Kirkpatrick, and G. L. Turner, "Multinuclear nuclear magnetic resonance and Raman investigation of sodium borosilicate glass structures," Phys. Chem. Glasses **31**, 30-41 (1990).
29. R. K. Brow, R. J. Kirkpatrick, and G. L. Turner, "Local structure of $\text{XAl}_2\text{O}_3 \cdot (1-x)\text{NaPO}_3$ glasses: an NMR and xps study," J. Amer. Ceram. Soc. **78**, 2293-2300 (1990).
30. R. K. Brow, R. J. Kirkpatrick, and G. L. Turner, "The short range structure of sodium phosphate glasses .I. MAS NMR studies," J. Non-Cryst. Solids **116**, 39-45 (1990).
31. J. Lipowitz and G. L. Turner, " ^{29}Si and ^{13}C magic angle sample spinning nuclear magnetic resonance spectroscopy of ceramic fibers prepared by prolysis of organosilicon polymers," in Solid State NMR of Polymers, L. J. Mathias, ed., Plenum Press, 305-320 (1991).

32. R. K. Brow, C. C. Phifer, G. L. Turner, and R. J. Kirkpatrick, "Cation effects on ^{31}P MAS NMR chemical shifts of metaphosphate glasses," J. Amer. Ceram. Soc. 74, 1287-90 (1991).
33. B.C. Bunker, R.J. Kirkpatrick, R.K. Brow, G.L. Turner, and C. Nelson, "Local structure of alkaline earth boroaluminate crystals and glasses: II. Boron-11 and aluminum -27 MAS NMR spectroscopy of alkaline earth boroaluminate glasses," J. Amer. Ceram. Soc. 74, 1430-8 (1991).
34. E. Oldfield, J. Chung, H. B. Le, T. Bowers, J. Patterson, and G. L. Turner, "Differential linebroadening in coupled carbon-13 magic-angle sample-spinning nuclear magnetic resonance spectra of solid polymers," Macromolecules, 25, 3027-30 (1992).
35. R. K. Brow, R. J. Kirkpatrick, G. L. Turner, "Nature of alumina in phosphate glass. II. Structure of sodium aluminophosphate glass," J. Amer. Ceram. Soc. 76(4), 919-28 (1993).
36. A. K. Jameson, C. J. Jameson, A. C. de Dios, E. Oldfield, R. E. Gerald, and G. L. Turner, " ^{129}Xe magic-angle spinning of xenon in zeolite NaA. Direct observation of mixed clusters of co-adsorbed species," Solid State Nucl. Magn. Reson. 4(1), 1-12 (1994).
37. J. L. Bass and G. L. Turner, "Anion distributions in sodium silicate solutions. Characterization by ^{29}Si NMR, infrared spectroscopy and vapor phase osmometry," J. Phys. Chem., 101(50), 10638-10644 (1997).
38. J. L. Bass, G. L. Turner and M. D. Morris, "Vibrational and ^{29}Si NMR Spectroscopies of Soluble Silicate Oligomers," Macromol. Symp., 140, 263-270 (1999).